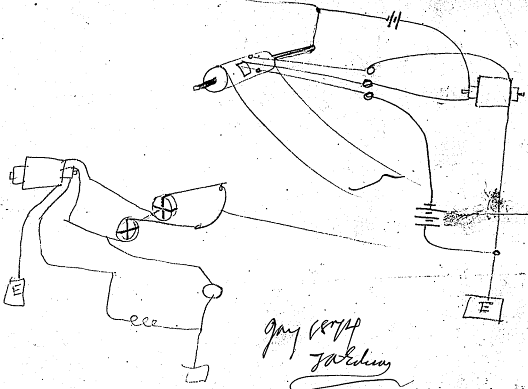
1874. Telegraph - General (NS-74-001)



Gray 1874

T A Edison

Roman
Wire
Caveat

(10)

10 is the drum by which the Chemically prepared paper is drawn forward a b c d is the four recording pens, c d are set the length of one letter ahead of a. b. ~~[illegible]~~ wires lead from A B to The Circuit changing ~~roller~~ Contact roller D.C. wires also lead from C D to The Contact roller and B A. These Contact rollers are so positioned regarding the two toothed wheels 2.3. which are insulated from each other the While at rest neither set of roller have Contact with the teeth of either wheel but while in motion C D first comes in Contact with the two teeth of the wheels 2.3, ~~[illegible]~~ (these wheels are Connected one with the

Line the other with the Earth through the points 4 & 5) after they leave the teeth B & A pass on a tooth, at no time is C-D & A-B on a tooth at the same time, It will be noticed that the recording pen a.b. are first connected with the line & ground by D.C. and record half of the letter, then the pen c.d. are connected to the line & Earth by the points A-B. recording the other half - when this is done a new tooth on the Escape wheel 8 will come in contact with the lever 6 of the ~~Steel~~ Magnet & the wheels 2.3 which are

Carried around by friction only will be arrested while the drum 10 will keep on at the moment the circuit changing wheels are stopped The Magnet receives a new impulse from the large hole in the perforated paper it releases the wheels 2 & 3. & another letter is printed,

I shall probably claim:

The arrangement of the transmitting pens for sending P & N Currents such as set forth & for purpose specified/

~~The use of a reg~~

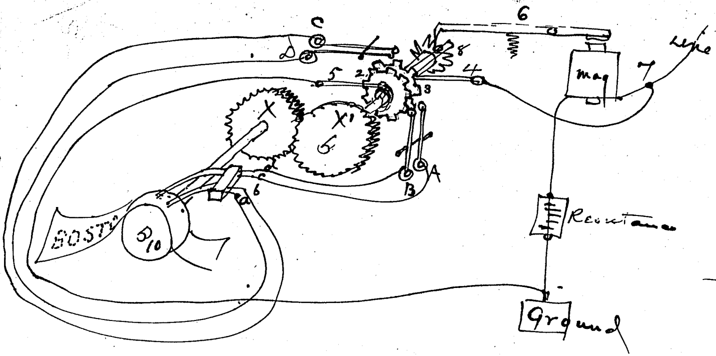
2 The use of an extra perforation in Roman letter perforated strips for regulating the distant recording machinery Either of the Each letter word or number of words

3rd The Circuit changer or its Equivalent for etc [illegible]

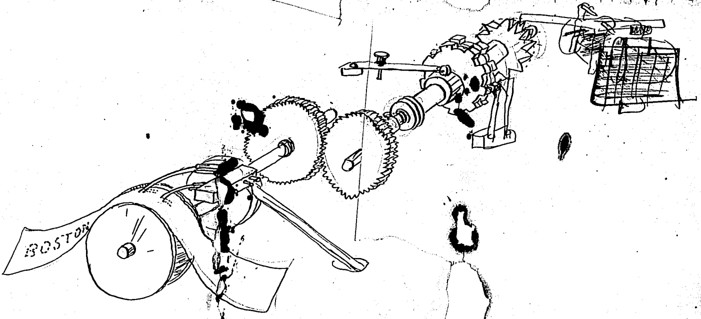
Set forth,

Edison

Feby 1 1874,

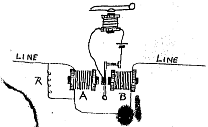


C
D
6
M
8
5
2
4
3
mag
7
Line
X
X'
G
A
B
c
b
BOSTN
B
10
Resistance
Ground



BOSTON

Feby 3 1874



usted that [illegible] line is closed or opened the lever stay
S[illegible] where [illegible] is placed. A is shunted by a
sistance. The power of the coils on A. are greater than
B but the resistance shunts some of the current &
makes A only equal to B. now on opening the
discharge from A circulating within the short
circuit formed by R. prolongs the time of its
demagnetization enough to put the armature
towards it on closing the Effect of the d
Induction (self) in A being within a cl
ckt prevents for an instant its magnetiza
hence the lever is attracted by B

Notes. 1

hen testing a long magnet for induction
ould be [illegible]rfectly s[illegible] w[illegible] the current
th[illegible] its helices otherwise the
[illegible]e[illegible] [illegible]r mark will be very irregular
~~caused by~~ the most minute disturbance of the
magnetism of the cores creating secondary
inductive discharges,

If a nearly exhausted battery or one which
is subject to polarization be placed in perm
Connection with the primary helice of a
induction Coil, a continuous discharg
be detected in the Secondary Coil. by m
walking across the room. ~~They~~ The lea
disturbance of the battery will tend to de
ct & increase for an instant its strength,
hence these Secondary discharges,

If a very long magnet with a great
number of Convolutions be placed in

2 Notes.

with a delicate mirror [illegible]
[illegible]ge (O[illegible]ter — fig —)
B [illegible] by one
a simple disk of zinc x
[illegible] in Sal Ammoniac, a
[illegible]ttery which is powerfully polarized
and the whole apparatus placed on
Masonry so as to secure perfect quiet
The Sound of the human voice ~~will~~
propogated through the air will be
Sufficient to depolarize the batter
for an instant and thus increases
Strength of the Current passing th
the Long Magnet sets up an induc
Current ~~which an~~ and the spot of lig
will move several degrees on the s
Sec if it will.

closes. a
n a
ttery power that the
s to give signal
. The addition of the
cal circuit of two grove batter be used
d the R of the sounder is small will
prevent the lever from working. The Current
is so powerful that the platina
points are held together ~~with Considerable~~
a force greater than that acting
the relay Illustration Relay 300
Circuit. 10,000 ohms 1 cell Da
Signals — dots per minute. On
addition of the local grove batty & sounder
no signals could be received. to ob
~~100~~ — dots per minute The resistance
was reduced to ——
By ~~dispo~~ inserting 2 Daniels in place
of the Grove: the resistance was
reduced Only to —— and whe
10 cells of ~~moist sawdust~~ high inten

notes 5

R. Daniel batteries were used in Conjunction with a Sounder of high R. no appreciable difference was obtained whether the Local Circuit was Connected or not =

When a Strong grove local is passed through a relay lever adjusted very fine ~~a slight~~ the Current produces a magnetic Effect in the armature If there be a slight permanent magnetism in the Cores of the Relay of the the same polarity as that induced into the armature by the passage of the Local Current The Lever of the relay will vibrate with great rapidity providing the Spring is very slack - ~~If the~~ By reversing the direction of the

Notes .6.

Local current through the relay lever the vibration will cease.

Tapping ~~dot~~ on a morse Key gives two breaks to every dot or dash. ~~at the~~ in making a dot, the moment the lever touches the contact point it rebounds and closes again, This may be detected by the inductive ~~to~~ Charges from an Electromagnet see fig — Chap — it is probable that the lever rebounds several times in forming a single dot thereby making several breaks of the Circuit, The inductive Charge of an Electromagnet is very sensitive to these breaks hence the time of magnetization is increased. These principle of this rebound is very much

8 notes,

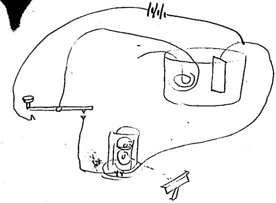
rebounds & so on this will take place when the sounder lever is prevented from working, the latter producing this result by ~~Com~~ jarring the ~~Int~~ Instrument tible,

The Grove Battery may be worked on the gravity plan ~~the platina~~ like a Calland the Zinc being placed at the top of the jar & the platina ~~set the bottom~~ a short distance from the bottom, ~~the Nitric acid~~. The jar being nearly filled with Water the Nitric acid is poured through a glass pipette or long ~~tube~~ funnel to the bottom, The internal R is greater than in the usual form but it gives off no fumes & is very Constant

The diffusion of the liquids, is entirely prevented, by placing the platina nearly at the point where the acid meets
~~Bitt Carbon~~ Bunsen Battery w
Bichromate Pot does not give as good results,

9 ~~15½~~ Notes

Leakage test — for high insulated Gutta Core short Lengths —



200 cells 10 minutes, press down Key. the Leakage will charge the tub as a secondary battery, so when you let Key go, the Current flows through Mirror, The Copper core of Cable forms one plate of ~~batter~~ Secondary battery & the regular Cop plate the other pole of Battery = Try

10 notes,

~~6 6 ohm Sounders may be worked from One two cell Main Line Grove battery without interfer~~

~~The induction Current. fr~~

Ten cells of battery ~~& of~~ 5 of which as opposed to the remaining 5, so that no current is generated, act as secondary batteries to any other battery: yeilding a current in the opposite direction to the battery Current

It is probable that no galvanic Current is Continuous but is Composed of an immense number of vibrations. Waves or pulsations, The Continuity of which is dependant

11 notes

upon the amount of matter ~~of~~ the
atteries themselves and in their
ghborhood. subject to static
duction, The great the Mass
of matter the more Continuous the
Current just as on ~~the Atlantic~~
~~Ca~~ a long submarine Cable
of great inductive Capacity
Several hundred dots
made at one end gives as
Continuous Current at the other.
~~Were it possible to obtain a~~
~~powerful battery of small surface~~
a

X

10 Cells of battery Connected
within a closed Circuit ~~in the~~
with a single cell ~~with~~ it
poles opposed to the 10 Cell
will remain unaffected until,
the ~~Curren~~ 10 Cells are nearly
Exhausted,

12 notes,

The R. of — Ferrid paper is ——
" " 16 to gal Iod Kali is —
2 " " —
Logwood formula —
& various Sols are —
ferro — as per Cully —

With delicate protoxide of iron solution for Chemical paper. the oxide formed by the action of the oxygen of the air on the pen is sufficient to give a light continuous mark. but this is not perceptible at very high speeds.

Dots & Dashes recorded on iodide of potassium paper may be transferred ~~that~~ to a like paper by ~~a~~ slight pressure & to dry paper by a heavy pressure —

13 Notes

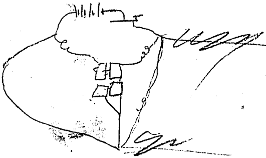
hard drawn platina gives the least spark -
may be drawn nearly as ~~so~~ hard as —— what steel

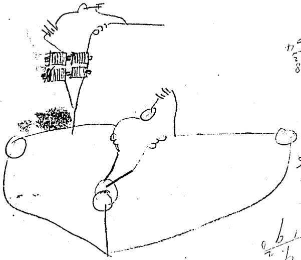
[illegible]w Carbons for Bunsen battery g~~enera~~
have an average resistance of — ohms
which decrease gradually to — ohm
in — days. ~~Constant use~~ on
Short circuit =
R of new porous Cups averages — ohms
which fall to — ohm in — —

The Evaporation of a gravity battery is
best prevented by a Wooden Cover
fitting loosely over the top of
the jar

The spark due to short circuiting a large
low R battery in which there is no
Electromagnet may be almost
annihilated by The addition of 50
ohms; within that portion which form the
short circuit -

Feby 5- 1874





22

19

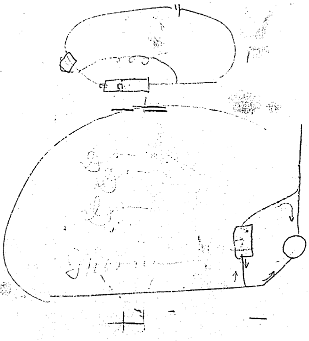
22

27

21

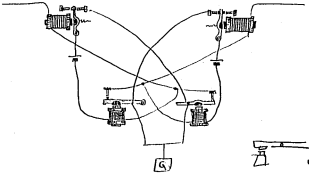
T A Edison Private papers
& Diagrams

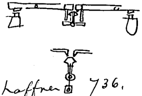
1860



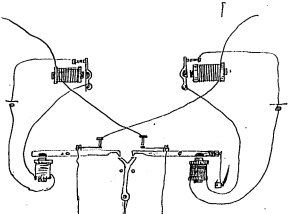
.1. Feby 74

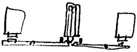
John J Speeds Repeater.
study it out Shafner 495–

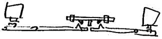




Farmers Repeater Shaffner 736.

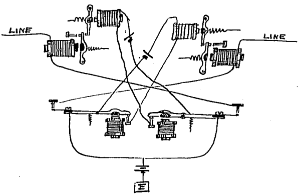






Millikens Rep. page 50.

2
Feby 14



Bunnells Repeater -

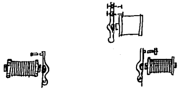
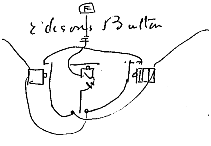
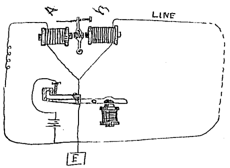


figure Bunnels Rout better page 52

Edisons Button



3. feby 14



This form of Duplex Relay was at one time used by Mr Stearns in his Duplex; but it worked unsatisfactory, and was abondoned by him for the double coil relay — Could this form of relay be used it would be of considerable Convenience in obtaining a balance, with the double coil relay the balance must be obtained by altering the plugs of the Rheostat forming the artificial Line, and it is not always possible to know whether to increase or decrease the R. and the amount necessary to regain the balance which is frequently disturbed ~~several~~ times.

Unbound Notes and Drawings, 1874-1878

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[This page should precede the document on Reel 7, Frame 30.]

4. feby 14

~~Each day~~ during the day but with the ~~double re~~ ~~retractile~~ Double magnet Relay any slight difference may be equalized for by adjusting the magnet A. to or from the armature, That magnet being provided with such a device; ~~Thus~~ and the equation made without the Loss of more than one word.

The defects of this relay Consists

1st. approaching of the armature ~~to~~ either one or the Cores of the Electromagnets when the outgoing Current is on gives that magnet a greater power over it —

2nd. The most serious evil arises from the fact that. The Route for the Self induction Currents generated in A. ~~have~~ are generated on a circuit having several thousand Ohms Resistance hence their Effect upon the ~~dis~~ Charging & discharge time of the Magnet A. is very small One the other hand. The discharge Route for The Self induction Current generated in the magnet B. owing to defective insulation has a much

5 feby 14

shorter circuit to discharge in
hence its ~~Electromagnetic~~ strength is
greater and its tendency is ~~to~~
~~prolong the magne line~~ on closing
to prevent the magnet B from being
instantly magnetized while ~~the~~
~~dual Charge~~ from A. having much
Charges almost instantly, this of
Course tends to draw the lever
for the first instant strongly
towards A. When the Current is
permanent. The ~~all~~ induction
Currents have subsided &
both magnets attract the
armature with Equal force
Now on opening. A almost
instantly loses its magnetism
while the discharge from B,
still Continues to circulate
through B & the circuit formed
by the line & derivations due to
Leakage & prolongs the magnetism
of B beyond that of A,
This of Course for the first instant
gives the lever a bias towards B,
The Greater the Escape the more perceptible
this difficulty will become,

lost ofte 5
1 mems feby 13

~~The unit of Capacity used in Cable work~~
a Microfarad, is that quantity of Current which with an Electromotive force of one Volt or Daniell Cell would flow through a circuit having a resistance of 1 Million Ohms or a Meagohm in one Second, About 3 Knots of the Core of the Atlantic Cable is equal to one Microfarad, That is to say if fully Charged equally by a Daniel Cell, it would give a discharge current the Total quantity of which would be equal to that given by the same Cell in a 1 Million ohm Circuit in one Second.

A Condenser is generally used for Comparing the Electrostatic Capacities of Cables

Varleys Condensers are made ~~of alternate~~ Alternate sheets of very thin paper & tin foil. ~~One side of his paper~~ The paper is saturated with parafine by dipping it into hot liquid parafine

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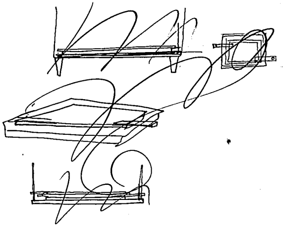
[These pages should probably follow the document on Reel 7, Frame 31]

2 memo 15 feby

Latimer
Clarks Condenser are made with ~~very thin~~ tin foil the sheets are Seperated by thin Sheets of Mica Coated with paraffine or Shellac Varnish,

Willoughby Smiths Condensers are made with tin foil the sheets be seperated with very thin ~~she~~ specially prepared Gutta percha, ~~figure~~
~~Shows the plan used by the [illegible]~~



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3 memo feby 15

The Capacity of Condensers are Expressed in micro farads

~~The~~ Mica Rubber; Gutta Percha parafined paper Each specific inductive Capacities, of Air. be taken as the unit then according to Latimer Clark. India rubber will ~~be about~~ has ~~almost~~ about 3 times the Electrostatic Capacity as air. Gutta percha 4 times. & mica 5 times, hence ~~A Condenser~~ of two Square feet of tin foil be seperated ~~by a sheet of~~ ~~the~~ one onethousands of an inch. and anther similar pair of plates be seperated by a sheet of mica of the same thickness as the stratum of air the ~~charge~~ The charge & discharge which will accumulate on the mica plates will be five times greater than on the ~~air~~ plates,

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4 Mem feby 15

Therefore if we wish to make a Condenser
of ~~hi~~great Capacity in small bulk
Mica is the best substance to use
Though Gutta percha Comes very near to it
and is probably More Economical
~~Though for Rough work Oakley will~~
In making a Condenser ~~all~~ the dialectric
or insulating sheets must be free from
holes; otherwise the insulation may be totally
distroyed ~~by~~
~~at~~ a plate of Gutta percha one foot
Square Surface and $\frac{1}{1000}$ of an inch
thick between two metal plates has a
resistance of 1066. ~~million ohm~~ megohm at 75 fahr
its Electrostatic Capacity is .1356. ~~at~~
microfarads ~~A microfarad is about~~ about 3 Knots of the
Atlantic Cable have a capacity of 1 microfarad hence it will take
8 sheets of Gutta ~~to~~ with their tin foil
armatures as above to construct a
Condenser with a capacity of 1
Microfarad. ~~If Glass was to be used~~
~~to separat~~ ~~of Glass in~~ if the thickness
of the Gutta percha was increased
to $\frac{1}{500}$ of an inch then it would

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[These pages should probably follow the document on Reel 7, Frame 31]

5 mem. feby 15.
be necessary to use 16 Sheets, ~~but~~
~~the insulation would be~~

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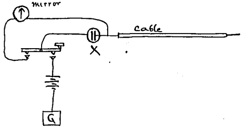
1 Book,

To take the Charge due to a ~~Batt~~ Cable



Close the key the static Charge rushes in the Cable, Charging the Large platina Secondary battery, the key is held down until Cable fully charged when it is lifted, touching the back stop this puts the secondary battery on short circuit through the mirror, the current of the secondary gradually Exhausts itself and the time it takes for the needle to settle to zero is in proportion to the amount of the charge

The better way would be to take the discharge as this would be free from the Current due to Leakage arranged this way. is shown on page 2 Book

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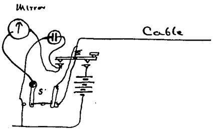
Page two Scrap book feby 15



Press down the Key and Charge the Cable for 1 minute then let go & Charge the Secondary Battery 1 minute. then disconnect Cable. and Close S. throwing Secondary Battery through Mirror on short circuit. and wait till Light goes to Zero - this will be in proportion to the Charge of Cable spread out in Longer time,

Unbound Notes and Drawings, 1874-1878

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[These pages should probably follow the document on Reel 7, Frame 31]

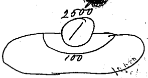
Shunts Feb 15 1874
2

To measure resistance of galvanometer & shunt combined.

Galv ~~minus~~ divided by shunt = A

Shunt ~~minus~~ divided by A = B

Shunt minus B = total resistance, for example:—



2500 ÷ 100 = 25—

100 ÷ 25 = 4

100 − 4 = 96 total resistance

---

another way:—

$$\frac{\text{Galvan} \times \text{shunt}}{\text{Galvan} + \text{shunt}} =$$

$$\frac{2500 \times 100}{2500 + 100} = \frac{250000}{2600}$$

```
2600)250000(96.
     23400
      16000
      15600
        400
```

```
100000
26
600000
200000
2600000
2404
2575.96
```

```
10096.
26
60576
20192
262496
```

```
262496.
2404
260092.
```

Unbound Notes and Drawings, 1874-1878

1874. Telegraph - General (NS-74-001)

[These pages should probably follow the document on Reel 7, Frame 31]

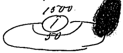
Shunts Feb 15 1874

~~Multiply the resistance of~~

Multiplying power of shunt

Resistance of galv. & shunt added together & divided by shunt equals the multiplying power of shunt.

thus if I have a galv. of 1500 ohms & shunt it with 50

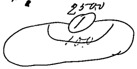


$\frac{1500 + 50}{50} = 31$ the multiplying power

~~To form a shunt of~~

To find the number of ohms there should be in a shunt to give it a definite multiplying power of $\frac{1}{10}$ $\frac{1}{100}$ $\frac{1}{1000}$ etc

Galvanometer divided by multiplying power wanted minus 1 equals number of ohms in shunt thus suppose you want to multiply 100 times on your galvanometer which is 2500 ohms then



$\frac{2500.}{100 - 1} = \frac{2500}{99} = 25\frac{1}{3}$ ohms

Total resistance of shunt & Galvan =

Galv − S = A S − A = B

S + B = total resist[illegible]

96.

Unbound Notes and Drawings, 1874-1878

1874. Telegraph - General (NS-74-001)

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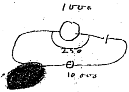
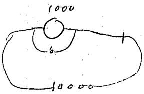
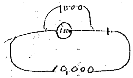

1000
250
10 000

250) 1000 (4.
1000

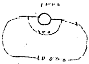
10.
4 0
40,000.


1000
6
10000

6) 10000
166-4
10 000
7,663,833 $\frac{1}{3}$.


1000
150
10,000

1000. 20000
500 40000


1000
500
10000

500.	20000
250	40000
125	80000
~~6~~62 $\frac{1}{2}$	160000
31 $\frac{1}{4}$	320000
15 $\frac{3}{4}$	640000
8 $\frac{1}{4}$	1280000

3 3 $\frac{1}{16}$

3) 1280000.
426666-2

1280000
426666
1,706666

Unbound Notes and Drawings, 1874-1878

1874. Telegraph - General (NS-74-001)

[These pages should probably follow the document on Reel 7, Frame 31]

1 Notes Feb 15th 1874.

~~Siemens~~ 1 ohm is equal to the resistance of a column of pure mercury ~~+oo~~ ~~of~~ 1 Square millimetre section & about 120 ~~ft or~~ metres long at ~~32~~ Fahrenheit
A Siemens unit is about $\frac{95}{100}$ths of an ohm.

If on a telegraph wire 400 miles in length all conditions the same, if the total amount of static charge be equal to 16 then by dividing the wire up into 4 parts of 100 miles each ~~that~~ part fr[illegible] battery will have a charge of 1 part the next will have 2 parts, the next 5 parts & the next 7 parts.
Hence the centre of accumulation of static charge is 120 miles from battery.
The quantity of inductive electricity accumulated on any telegraph wire of say 400 miles in length

2 Notes Feb 15 74

is proportional to the diam. of wire. its distance from ground, number of wires on the pole, distance of wires apart, mass of matter in pole & insulator. The time that this accumulation will practically cea after the battery has been disconnec is in proportion to the resistance o the wire itself & all its derivatio formed by the leakage.

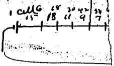
The electromotive [illegible] a [illegible]an cell whose Cop plate is immersed in conc sol of Sulph of Cop & whose of Zinc as immersed in dilute of sulphuric a of the proportion of 1 - 4th pa. is now usually adopted as the unit of EMF

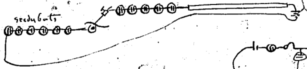
Sabine 317.

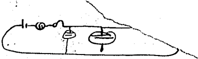
3 Notes Feby 15

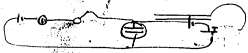
Fechners method of comparing the electromotive force of 2 elements consists in measuring the intensities of 2 currents when R are equal He employs a galvan. with fine wire & many convolutions wound & places this Galvan & Battery in a circuit of large R say 10'000 ohms in order to be able to neglect the R of the element itself

1874 Feby 17. Cable

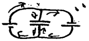

1 cell 6
15
18 18
30 11
42 9
54 7

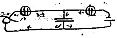

seedy batts





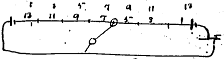
15
6
90

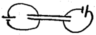


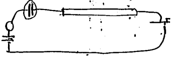


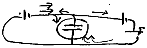
13
6
78

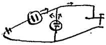
11
6

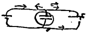

1 3 5 7 9 11 13
13 11 9 7 5 3 1

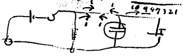


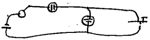


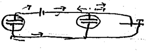


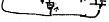








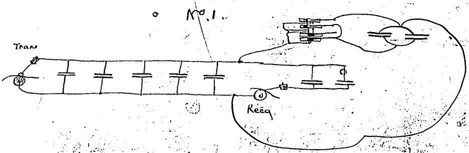




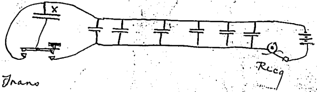
May 16 1874.

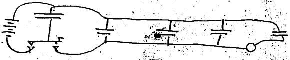
Experements por Socitié du Cable Transatlantique Français
Par Mrs Edison & Batchelor

No. 1.



X is of same Capacity as now used on end
viz 1 Bunder & Red =

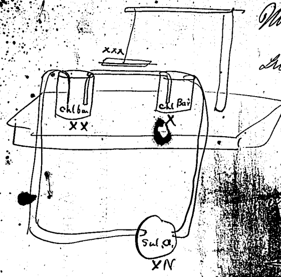

X
Recq
Trans

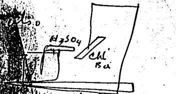


Ink Records

Nov. 2nd 1874

Tried this
No good
C & B


XXX
Chl bar
XX
Chl Bar
X
Sul. a.
XN

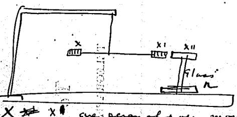

H2SO
H2SO4
Chl
Ba

drop the SO_3 on paper see if Chl Ba is attracted,

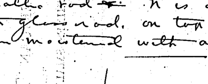
XX. Ch bar
XX also H_2O & Various [illegible]
XXX Ch Bar
also H_2O in XX & X Chl Bar in XXX
& SO_3 in XN. Chemical affinity ought to draw XXX from right angle to parallel,

4

also try this way,

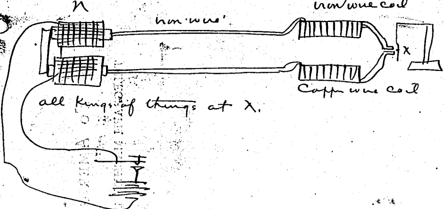

X
X1
X11
Glass
R

X ~~#~~ X1 are piece of paper moistened with the solution and around to piece of glass rod, also to metallic rod ~~X~~. R is a standard with glass rod. on top is X'' a piece of paper moistened with another solution,


Phosphor
H2O.
glass tube,

5

Nov 2nd 1874

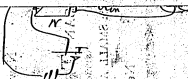


all Kinds of things at X.

N Battery Copper disk quantity Magnet here with quantity magnet —

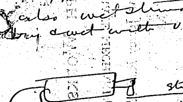
dispense with Copper coil & iron coil used Large iron wire 50 feet long both ends also do. Copper & iron also wet string & iron wire, string moistened with various chem Sols, also copper wire & wet string also close these various Conductors of Odic magnetism together when X is attached =

when Current is on break Contact of iron or copper from Cores of magnet



shunted
also Bradley
No 1, 2, 3 & 4
Coils,

Cores of N Connected, to opposite & in regular way — also used 1 iron & copper also 2 copper wires, also wet string, organic conductors, dry & wet with various chems,



strip of paper wet in various subs that decompose in air & by battery see if pyrogallic a & iod K decom in magnetic field also connecting to oppose

To

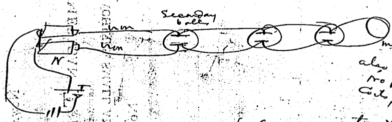
TELEGRAPH

6

also send reverse Current,
Try at X tubes, with various chems in

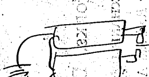
also Connect the two helices of Electromagnet Opposite so they oppose & produce no magnetism and try all over again —

& this



shunted
also Bradley
No 1, 2, 3 & 4
Coils,

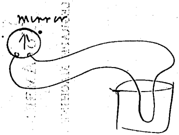
Core of N Connected, to opposite & in regular way — also used 1 iron & copper also 2 copper wires, also wet string, organic conduct; try direct with various chems,



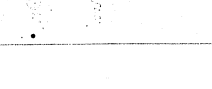
strip of paper wet in various subs that decompose in air & by batty see if iod K pyrogallic a & decomp in magnetic field also connecting to oppose

7 Nov 2 1874

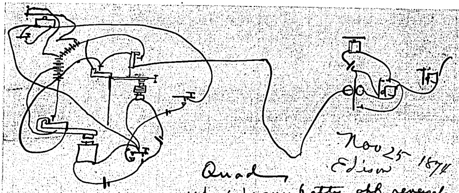
shellac;
glass
Tubes with hydrocarbons;
Tube with metal inside with acid attacking them —
Salt crystalizing —



Various chemicals with loops of various wires, precipitates formed & crystalizing also acids to attack metal immersed, also this



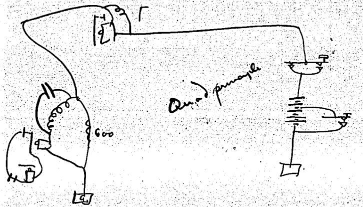
Exp. to find some new phenomena



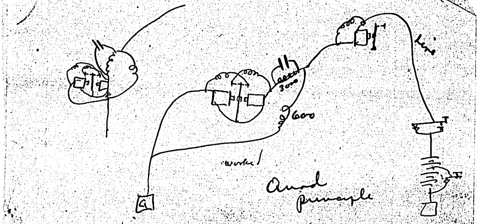
Nov 25 1874
Edison

Quad

when heavy batty off reversals work plzd relay when heavy batty reversals prevented from being sent Extra heavy batty used instead which wkg an Extra magnet Keeps local closed while plzd tongue goes over would open



Quad principle



works!

Quad principle